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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/772,740	02/05/2004	Yonhua Tzeng	220101-1011	5635

24504 7590 06/29/2006

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EXAMINER
FULLER, ERIC B

ART UNIT	PAPER NUMBER
1762	

DATE MAILED: 06/29/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/772,740	TZENG, YONHUA	
	Examiner	Art Unit	
	Eric B. Fuller	1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-27* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-27* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 1.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 2 and 14-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

These dependent claims all specify what the carrier gas or the reactive gas is. However, they depend from claims that claim "in the absence of a carrier gas" and/or "in the absence of a reactive gas". Thus, the scope of these claims is confusing as they further limit something that is explicitly not present in the independent claim.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Semiconductor Energy Lab (JP 05-097583 A), referred to hereinafter as SEL, in view of

Pryor (USPN 5,236,545) and either Versteeg et al. (USPN 5,451,260) or Robson et al. (USPN 5,874,014).

SEL teaches a method for forming diamond crystals or a diamond film (Abstract), the method comprising disposing a substrate "4" in a reaction chamber (paragraph [0011] and Figures 1 and 3), introducing, in the absence of a gas stream, a precursor containing methanol or ethanol (i.e., a carbon and oxygen containing compound having a carbon to oxygen ratio greater than one) into an inlet of the reaction chamber (Figures 1 and 3, Abstract, and paragraphs [0010] – [0012]), vaporizing the liquid precursor (paragraph [0012]), and subjecting the vaporized precursor, in the absence of a carrier gas, to a plasma under conditions effective to excite the precursor and promote diamond growth on the substrate (paragraphs [0010] – [0020]). Further, the liquid precursor taught by SEL is 100% alcohol (paragraph [0010]), and none of the examples of diamond deposition taught by SEL include any water in the liquid precursor material (paragraphs [0013] – [0020]). As such, the liquid precursor of SEL is substantially free of water. In addition, although SEL uses the term "excited" as opposed to "disassociated" to refer to the vaporized precursor material (paragraph [0011]), a microwave-based plasma is formed (paragraph [0011]) and therefore the vaporized precursor material is inherently disassociated (i.e., because a plasma inherently contains disassociated material species). SEL does not explicitly teach that the liquid precursor contains methanol and at least one carbon and oxygen containing compound having a carbon to oxygen ratio greater than one. Specifically, SEL teaches liquid precursors such as methanol and ethanol (Abstract and paragraph [0011]) and that the

diamond can be deposited "with 100% of alcohols" (paragraph [0010]), but does not explicitly teach using a combination of methanol and another compound having a carbon to oxygen ratio greater than one as the liquid precursor. However, Pryor teaches that, in the art of depositing diamond films by a microwave plasma CVD process (i.e., a process analogous to that of SEL), carbon-containing precursors such as methanol or ethanol can be utilized, as well as mixtures thereof (Col.9, lines 3 – 20). In other words, Pryor teaches the functional equivalence of individual methanol and ethanol precursors (e.g., as suggested by SEL) and combined methanol / ethanol precursors for depositing diamond in a plasma enhanced CVD process. Therefore, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to utilize a mixed methanol / ethanol liquid precursor mixture in the process of SEL with the reasonable expectation of success and obtaining similar results (i.e., successfully depositing a diamond film on a substrate by using liquid alcohol-based precursors without a carrier gas, specifically hydrogen, as desired by SEL) when compared to utilizing either methanol or ethanol precursors individually.

Additionally, with respect to the independent claims, SEL does not explicitly teach that the alcohol-based liquid precursor is a liquid when introduced into the inlet of the reaction chamber. Specifically, SEL teaches that vapor of the liquid precursor is introduced into the reaction chamber (paragraphs [0011] and [0012]). Versteeg et al. teach a liquid delivery system and method for the CVD of films in a reaction chamber (Abstract). Versteeg et al. also teach that any liquid organic precursor solution can be used in their liquid delivery system (Col.2, lines 14 – 15) and that a wide variety of films

can be deposited (Col.5, lines 50 – 56). The liquid delivery system can be utilized in a microwave plasma enhanced deposition processes (i.e., a process analogous to that of SEL and Pryor) (Col.2, lines 66 – 68, and Col.3, lines 1 – 2). In this system, a mist of the liquid precursor is introduced into an inlet of the reaction chamber, after which the liquid precursor is vaporized and comes into contact with a substrate to deposit a film (Col.2, lines 3 – 13 and 44 – 68, and Col.3, lines 1 – 14). Versteeg et al. teach that this method of precursor delivery is extremely simple and economical, and it avoids the need for cumbersome mass flow controllers, carrier gases, and heated sources and lines (Col.5, lines 36 – 44). It would have been obvious to one of ordinary skill in the art to utilize the liquid delivery system and method of Versteeg et al. to introduce the alcohol-based liquid precursor of SEL (i.e., to introduce the precursor as a liquid into the inlet of the reaction chamber) with the reasonable expectation of (1) success, as the precursors of SEL are alcohols (i.e., organic liquids), and Versteeg et al. teach that any liquid organic precursor solution can be used in their liquid delivery system and that the system can be utilized in a microwave plasma enhanced deposition processes (i.e., such as the one of SEL), and (2) obtaining the benefits of using the aforementioned liquid delivery system, such as its simplicity, economic nature, and avoidance of cumbersome mass flow controllers, carrier gases, and heated sources and lines. Robson et al. teach that, in the process of depositing diamond from precursors such as ethanol, methanol, and isopropanol, the precursors are generally gaseous or vaporize to a gaseous form upon introduction into the deposition chamber (Col.13, lines 15 – 26). Therefore, it would have been obvious to one of ordinary skill in the art to introduce the liquid precursors of

SEL into an inlet of the reaction chamber of SEL and subsequently vaporize the precursors (i.e., as opposed to first vaporizing the precursors and then introducing the vapor, as suggested by SEL) with the reasonable expectation of (1) success, as Robson et al. teach that such as process was known in the art at the time of the applicant's invention, and (2) obtaining similar results (i.e., successfully depositing diamond from a liquid precursor, regardless of whether the liquid precursor is vaporized prior to introduction into an inlet of a deposition chamber or after introduction into the inlet).

Regarding the limitation that the reaction chamber be in a "non-magnetic microwave field plasma system", the combination of SEL, Pryor, and either Versteeg et al. or Robson et al. teaches this limitations. Specifically, SEL teaches that a diamond film according to their invention can be formed by using a microwave plasma CVD system that does not use a magnetic field (Figure 1 and paragraphs [0019] – [0022]). SEL teaches that this system has an advantage, namely that the equipment is very simple and cheap because no magnetic field is used (paragraph [0019]). Therefore, it would have been obvious to one of ordinary skill in the art to utilize a "non-magnetic microwave field plasma system" as taught by SEL in the diamond deposition process of the combination of SEL, Pryor, and either Versteeg et al. or Robson et al. with the reasonable expectation of (1) success, as both SEL and Pryor teach that non-magnetic field microwave plasma systems can be successfully utilized to deposit diamond, and (2) obtaining the benefits of using a non-magnetic field system as opposed to a system

that uses a magnetic field, such as the ability to use equipment that is very simple and cheap, as taught by SEL.

SEL does not explicitly teach the applicant's claimed pressure range of about 70 to 130 Torr. However, it would have been obvious to one of ordinary skill in the art to determine the operating pressure, through routine experimentation, absence evidence of criticality.

As to claims 5-8 and 11-13, since Pryor teaches the functional equivalence of methanol and ethanol, to use any relative amount of methanol to ethanol would have been obvious at the time the invention was made to a person having ordinary skill in the art, absence evidence of criticality.

As to claims 9, 19, and 20, the methanol is supplemented with one or more carbon and oxygen containing compounds containing carbon, hydrogen, and oxygen with an atomic ratio of carbon to oxygen greater than one, preferably ethanol, isopropanol, acetone, or combinations thereof (shown above).

As to claim 22, the substrate comprises a sheet or wafer of silicon, copper, aluminum, molybdenum, or alloys thereof (Examples 1 – 3 of SEL).

As to claims 2 and 14-20, the carrier gas is hydrogen (Abstract and paragraphs [0010] and [0023] of SEL).

All other limitations are taught in the specific embodiments of SEL.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric B. Fuller whose telephone number is (571) 272-1420. The examiner can normally be reached on Mondays through Thursdays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tim Meeks, can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

EBF

TIMOTHY MEEKS
SUPERVISORY PATENT EXAMINER